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ABSTRACT

To observe the impact of teachers' verbal behavior upon the verbal behavior of students, 12 intermediate grade teachers and their classes were identified in 10 rural schools near Fresno, California. The 10 schools were chosen to participate in the study because of their in-service teacher program. Teachers from five randomly selected schools received training in the use of Parsons' Guided Self-Analysis (GSA), the other group became a control group. There were three fifth and three sixth grade teachers in each group. Each teacher was videotaped four or more times after treatment began. The pupils in the classes were pre- and post-Tested, using two published critical thinking tests. The test results and the first and last sets of videotapes were the sources of data used for the study. The two groups of teachers were not significantly different on 13 variables of teacher behavior prior to treatment. The two groups of classes of pupils were not significantly different on 7 variables of pupil behavior prior to treatment. At the end of 13 weeks of treatment, the two groups of teachers were statistically different on 4 of 7 variables. These differences were attributed to treatment effects. A 17-item bibliography is included. (Author/MJM)

ED 065457

"MODIFICATION OF THE VERBAL BEHAVIOR OF TEACHERS: ITS IMPACT ON THE VERBAL BEHAVIOR OF PUPILS"

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Introduction

The research reported by this paper was conducted in ten rural schools (districts) near Fresno, California. The experimental period extended from early February to mid-May, 1971. Ten schools had been identified as prospective recipients of inservice training for their teachers. Five of the schools were randomly selected from the ten to receive the experimental treatment. The remaining five received no treatment and served as an experimental control. There were three 5th and three 6th grade teachers in each of the two experimental groups, or a total of twelve teachers participating in the study.

The Experimental Treatment Variable

The trainers of teachers in each of the five experimental group schools received training in December 1970. The training was presented by Theodore Parsons and his staff and was designed to prepare the trainers to conduct regular workshops for participating teachers at their school site.

The participants themselves attended training workshops presented by trainers to learn how to employ a self-supervisory procedure for monitoring and classifying their own verbal (oral) teaching behavior.1/ Essentially, the procedure provided teachers with a detailed model for analyzing their classroom questioning and response strategies and for identifying the functions of their classroom talk. The model also focused the user's attention on the amount and proportion of classroom talk which was not pupil talk. However, the training and the repeated use of the GSA coding procedure was designed to bring the teacher to an awareness of his verbal behavior and its potential impact on pupils.

If the training workshops are to be judged successful, the teacher will have contrasted his actual (observed) behavior with his perception of what his behavior should be; and if a discrepancy

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1/ The procedure was developed by Theordore W. Parsons. It is presented in detail in four volumes (schedules) of programmed materials entitled Guided Self-Analysis for Professional Development, Education Series, Hereafter GSA. See Theodore W. Parsons in Bibliography.

existed between his 'actual' and his 'ideal' behavior, the teacher will have modified his 'actual' behavior to make it more like behavior he believes to be 'ideal' teaching behavior.

The teachers in the treatment group learned the coding procedure by analyzing a videotape recording of classroom teaching provided by the trainer. In that the intent of GSA was to induce self-managed professional development, participants were not trained to criterion in their coding. However, discussion of coding results was extensive and consensus of coding results was reported by trainers and participants alike.

Prior to the beginning of any training, teachers were instructed in the use of VTR equipment and each participant made a videotape he felt to be a typical sample of his teaching behavior in a social science class setting.

Following their training in GSA 'coding', teachers coded and analyzed videotapes of their own teaching behavior. Based upon their analyses, they modified their behavior, made a new videotape, and analyzed it. Four repetitions of the tape/code/analysis cycle were made by each experimental group teacher prior to his making the fifth videotape recording.

The control group teachers also made five videotape recordings of their classroom teaching about once every three weeks during the 13 week experimental period. The teachers viewed their videotapes without the benefit of GSA or any other training in interaction analysis.

The videotape recordings of both groups of teachers were analyzed by the researcher. However, only the first and last tapes were utilized to provide data for hypothesis testing.

Statement of the Problem

Do four cycles of GSA treatment produce observable changes in the verbal behavior of teachers? And if teachers do alter their verbal behavior, do their pupils alter their verbal behavior as a result?

Definition of Terms:

GSA cycle implies

(1A) videotaping one's classroom teaching

(1B) coding the taped verbal behavior according to GSA definitions

(1C) analyzing the results

(1D) modifying subsequent behavior prior to next videotaping

(2A) videotaping the modified behavior

(2B, 2C, 2D) Same as 1B, 1C, and 1D preceding

Verbal behavior of teachers implies thirteen variables in the behavior of teachers:

Questions [2]

1. percent of rhetorical questions
2. percent of information seeking questions
3. percent of leading questions (open ended questions)
4. percent of probing questions (require generalization as an answer)
5. percent of questions logically related to the question preceding them

Responses [3]

6. percent closure responses (terminate pupil talk or thinking)
7. percent of sustaining responses (sustain pupil thinking at same cognitive level)
8. percent of extending responses (elevate pupil thinking to a higher cognitive level)

Function of teacher talk [4]

9. percent of talk interactive with pupils (questions and responses)
10. percent of talk which is instruction (non-interactive)
11. percent of talk which is managerial

Teacher/Pupil Patterns [5]

12. teacher talk as a percent of total classroom talk
13. average number of words per teacher utterance.

Verbal behavior of pupils implies seven variables in the behavior of pupils:

1. pupil talk as a percent of total classroom talk

2/ See Schedule A of GSA
3/ See Schedule B of GSA
4/ See Schedule C of GSA
5/ See Schedule C of GSA

2. average number of words per pupil utterance

3. percent of pupil talk which is analysis
   N.B., pupil talk was coded as analysis if the content of such talk indicated that the pupil had generated a principal which accounted for specific conceptual patterns among the data, or if it indicated a non-routine application of a known principle to a novel set of data.

4. percent of pupil talk which is grouping
   N.B., pupil talk was coded as grouping if its content reflected thinking requiring pupils to sort data according to certain abstract or concrete attributes they did or did not possess.

5. percent of pupil talk which is recall
   N.B., pupil talk was coded as recall if it reflected thinking which required pupils to remember facts or experiences, or to make a choice among several items, or to arrange items sequentially.

6. mean raw score on the Cornell Class Reasoning Test, Form X..

7. mean raw score on the Cornell Conditional Reasoning Test, Form X.

Hypotheses

The purpose of the study was twofold. First, it examined the effects of GSA use on the verbal behaviors of teachers as indicated by mean measures of thirteen variables in teacher behavior. Its second purpose was to examine the effects of GSA induced modifications of teaching behavior (if any) upon the verbal behavior of pupils as revealed by mean measures on five variables in their oral behavior and two mean measures of their critical thinking skill. The hypotheses relative to the objectives of the study are stated in null form.

1. The mean measures on thirteen verbal behavior variables for teachers in the control and experimental groups will not differ significantly as a result of GSA treatment (α = .01).

2. The mean measures on seven verbal behavior variables for pupils of teachers in the control and experimental groups will not differ significantly between groups (α = .01).

Data on Classroom Behavior

The data derived from the videotape recordings for both teachers and pupils were gleaned from ten minute segments of each twenty minute sample videotape. Each ten minute segment was selected after approximately five minutes of tape were played. It was felt that both teacher and pupil behavior were regularized after five minutes of taping. Hindsight suggests that the assumption was a legitimate one.

The teacher and pupil data were extracted from the same ten-minute segment of each tape. Class means for pupil behavior variables were used as raw data in that teachers were the experimental units. Data for teachers are reported in Tables 1a, 1b, and 2a, 2b. Pre and post experimental data for classes of pupils (control vs. experimental) are reported in Tables 3 and 4, respectively.

Pupil data were listed gradewise (Tables 5 and 6) and raw data for pupils were standardized gradewise for analysis. Thus, data for analysis were distributed N(10,1).[6/] Standardized pupil data are listed in Tables 7 and 8.

Pre-Experimental Status of the Sample

Using data derived from the pre-treatment videotapes, the teachers in the control and experimental groups were not found to be statistically different on any of the thirteen teacher behavior variables of interest (Tables 1a, 1b and 9). Further, the pre-treatment videotapes were used to generate mean data for five variables in the verbal behavior of pupils in classes of participant teachers. The pretest results of the two critical thinking tests provided two other measures of pupil behavior. Those data were standardized gradewise and no differences were detected between groups on any of the seven pupil behavior variables (Tables 7 and 10), and to the extent that the occupations of parents are indicators of SES status on the WARNER occupational scale, the two pupil groups were not found to be socio-economically different.[7/] Significance testing to detect pre-treatment differences was done at the .01 level in order to limit total type I error and one-way ANOVA was used to compute each test statistic.

Based upon the foregoing analysis of pre-treatment data, the control and experimental groups were assumed to be equivalent with respect to thirteen variables of teacher behavior, seven variables of pupil behavior and the mean SES of the pupils in classes of participant teachers.

Hypothesis Testing

Having failed to reject the hypotheses of equivalence between groups at the outset of experimental treatment, one-way ANOVA was used to detect between group post treatment differences for each variable

6/ Ten was added to each standard score to facilitate subsequent computations; thus N(10,1) instead of N(0,1).

7/ See WARNER in bibliography

TABLE 1a

DATA ON THIRTEEN TEACHER BEHAVIOR VARIABLES
FOR EXPERIMENTAL GROUP TEACHERS

Pre-Treatment Data
February 1971

	VARIABLES	EXPERIMENTAL							
		Grade 5			Grade 6			$\bar{X}$	SD
Questions	% Rhetorical	28.1	12.5	24.0	22.7	25.0	28.6	23.48	5.85
	% Information	71.9	70.8	68.0	68.2	68.7	71.4	69.83	1.73
	% Leading	0	12.5	8.0	9.1	6.3	0	5.98	5.06
	% Probing	0	4.2	0	0	0	0	0.70	1.71
	% Related	25.0	20.8	28.0	22.7	12.5	25.0	22.33	5.39
Responses	% Closure	78.6	81.5	85.2	66.7	73.7	80.0	77.62	6.53
	% Sustaining	17.9	18.5	14.8	33.3	26.3	20.0	21.80	6.79
	% Extending	3.5	0	0	0	0	0	0.58	1.43
Function	% Questions and Responses	60.0	81.1	52.0	68.2	67.4	67.9	66.10	9.70
	% Instruction	22.2	10.8	16.0	13.6	16.3	28.6	17.92	6.45
	% Management	17.8	8.1	32.0	18.2	16.3	3.5	15.98	9.83
Amount	% Teacher Talk	74.4	69.0	71.8	66.2	74.6	69.6	70.93	3.29
	Average # of words per utterance	7.81	7.84	5.57	8.43	6.96	9.41	7.67	1.31

TABLE 1b

DATA ON THIRTEEN TEACHER BEHAVIOR VARIABLES
FOR CONTROL GROUP TEACHERS

Pre-Treatment Data
February 1971

	VARIABLES	CONTROL							
		Grade 5			Grade 6			$\bar{X}$	SD
Questions	% Rhetorical	37.5	33.3	19.2	41.2	20.0	17.4	28.10	10.42
	% Information	58.3	58.3	80.8	58.8	80.0	65.2	66.90	10.80
	% Leading	4.2	8.4	0	0	0	17.4	5.00	6.94
	% Probing	0	0	0	0	0	0	0	0
	% Related	16.7	25.0	34.6	11.8	20.0	30.4	23.08	8.58
Responses	% Closure	77.8	61.2	80.9	82.3	87.5	80.0	78.28	8.85
	% Sustaining	16.7	38.8	14.3	17.7	12.5	13.3	18.88	9.96
	% Extending	5.5	0	4.8	0	0	6.7	2.83	3.16
Function	% Questions and Responses	72.1	80.00	48.8	61.6	47.1	51.2	60.13	13.54
	% Instruction	20.9	6.7	24.4	26.9	23.5	31.1	22.25	8.36
	% Management	7.0	13.3	26.8	11.5	29.4	17.7	17.62	8.85
Amount	% Teacher Talk	77.6	76.4	91.3	71.1	77.5	77.4	78.55	6.72
	Average # of words per utterance	7.60	7.19	4.78	9.19	11.43	6.94	7.86	2.25

TABLE 2a

DATA ON THIRTEEN TEACHER BEHAVIOR VARIABLES
FOR EXPERIMENTAL GROUP TEACHERS

Post-Treatment Data
May 1971

	VARIABLES	EXPERIMENTAL							
		Grade 5			Grade 6			$\bar{X}$	SD
Questions	% Rhetorical	8.7	0	20.8	0	0	11.1	6.77	8.45
	% Information	30.4	59.3	41.7	63.6	58.6	55.5	51.52	12.77
	% Leading	52.2	29.6	29.2	31.8	31.0	27.8	33.60	9.22
	% Probing	8.7	11.1	8.3	4.6	10.4	5.6	8.12	2.58
	% Related	56.5	48.1	58.3	68.2	41.4	50.0	53.75	9.33
Responses	% Closure	57.9	51.7	40.0	47.4	31.8	33.0	43.63	10.48
	% Sustaining	26.3	34.5	40.0	42.1	45.5	50.0	39.73	8.39
	% Extending	15.8	13.8	20.0	10.5	22.7	16.7	16.58	4.35
Function	% Questions and Responses	84.0	76.5	79.4	84.2	92.9	60.9	79.65	10.74
	% Instruction	12.0	23.5	14.7	5.3	7.1	39.1	16.95	12.62
	% Management	4.0	0	5.9	10.5	0	0	3.40	4.28
Amount	% Teacher Talk	51.7	45.6	56.3	67.0	55.6	89.3	60.92	15.57
	Average # of words per utterance	9.75	6.86	11.47	7.14	6.13	11.30	8.78	2.36

TABLE 2b

DATA ON THIRTEEN TEACHER BEHAVIOR VARIABLES
FOR CONTROL GROUP TEACHERS

Post-Treatment Data
May 1971

	VARIABLES	CONTROL							
		Grade 5			Grade 6			$\bar{X}$	SD
Questions	% Rhetorical	50.0	18.5	27.3	20.0	18.5	13.0	24.55	13.29
	% Information	42.3	70.4	68.2	73.3	70.4	78.3	67.15	12.66
	% Leading	7.7	11.1	4.5	6.7	7.4	8.7	7.68	2.19
	% Probing	0	0	0	0	3.7	0	0.62	1.51
	% Related	34.6	25.9	31.8	26.7	29.6	26.1	29.12	3.54
Responses	% Closure	92.3	69.6	81.3	78.6	88.2	86.4	82.73	8.08
	% Sustaining	7.7	26.1	18.7	21.4	11.8	13.6	16.55	6.77
	% Extending	0	4.3	0	0	0	0	0.72	1.76
Function	% Questions and Responses	67.6	79.4	63.0	60.9	68.6	58.1	66.27	7.56
	% Instruction	16.2	10.3	26.1	26.1	25.7	25.6	21.67	6.78
	% Management	16.2	10.3	10.9	13.0	5.7	16.3	12.07	4.02
Amount	% Teacher Talk	80.7	74.8	83.8	76.2	88.7	77.4	80.27	5.26
	Average # of words per utterance	7.10	8.40	8.70	7.00	7.81	9.36	8.06	0.93

TABLE 3

PRE-TREATMENT DATA FOR THE PUPILS OF PARTICIPATING TEACHERS ON SEVEN PUPIL BEHAVIOR VARIABLES

Control vs. Experimental

		Pupil Talk As A % Of All Class Talk	Average # Of Words Per Pupil Utterance	% Of Pupil Talk Coded As Analysis	% Of Pupil Talk Coded As Grouping	% Of Pupil Talk Coded As Recall	Cornell Class Reasoning	Cornell Conditional Reasoning
CONTROL	GRADE 5	22.4	5.52	0	5.6	94.4	23.8	45.7
		23.6	7.38	0	10.5	89.5	5.3	21.7
		8.7	1.15	0	23.1	76.9	31.2	37.2
	GRADE 6	28.9	6.86	0	11.5	88.5	34.1	39.3
		22.5	2.80	0	12.5	87.5	30.4	35.7
		22.6	3.71	0	25.0	75.0	25.7	30.7
	$\bar{X}$	21.45	4.57	0.00	14.70	85.30	25.08	35.05
	σ	6.72	2.43	0.00	7.64	7.64	10.40	8.17
EXPERIMENTAL	GRADE 5	25.6	8.47	2.7	21.6	75.7	24.0	37.1
		31.0	5.22	0	11.1	88.9	23.0	27.5
		28.2	6.06	0	14.8	85.2	19.6	34.5
	GRADE 6	33.8	6.11	0	16.6	83.4	24.4	39.6
		25.4	4.95	0	14.8	85.2	35.2	41.1
		30.4	5.19	0	16.1	83.9	17.8	21.0
	$\bar{X}$	29.06	6.00	0.45	15.83	83.72	24.00	33.47
	σ	3.29	1.30	1.11	3.42	4.38	6.07	7.76

TABLE 4

POST-TREATMENT DATA FOR PUPILS OF PARTICIPATING TEACHERS ON SEVEN PUPIL BEHAVIOR VARIABLES

Control vs. Experimental

		Pupil Talk As A % Of All Class Talk	Average # Of Words Per Pupil Utterance	% Of Pupil Talk Coded As Analysis	% Of Pupil Talk Coded As Grouping	% Of Pupil Talk Coded As Recall	Cornell Class Reasoning	Cornell Conditional Reasoning
CONTROL	GRADE 5	19.3	5.88	0	13.3	86.7	23.2	30.7
		25.2	2.69	0	4.5	95.5	13.4	23.9
		16.2	4.90	0	10.0	90.0	34.8	43.7
	GRADE 6	23.8	3.62	0	5.6	94.4	38.1	46.8
		11.3	2.08	0	0	100.0	33.6	44.9
		22.6	4.15	0	11.8	88.2	33.9	38.5
	$\bar{X}$	19.73	3.89	0.00	7.53	92.47	29.50	38.08
	σ	5.26	1.40	0.00	5.04	5.05	9.35	9.05
EXPERIMENTAL	GRADE 5	48.3	8.47	12.5	54.2	33.3	26.5	48.8
		54.4	6.00	6.3	31.2	62.5	33.6	58.4
		43.7	14.25	8.0	72.0	20.0	33.0	59.0
	GRADE 6	33.0	4.81	8.0	40.0	52.0	30.9	39.8
		44.4	7.23	4.2	29.1	66.7	48.7	49.4
		10.7	6.29	0	58.3	41.7	24.6	26.7
	$\bar{X}$	39.08	7.84	6.50	47.47	46.03	32.88	47.02
	σ	15.57	3.37	4.20	16.87	17.85	8.53	12.22

TABLE 5

GRADEWISE ORGANIZATION OF PRE-TREATMENT DATA
FOR PUPILS ON SEVEN PUPIL BEHAVIOR VARIABLES

Grade 5 vs. Grade 6

		Pupil Talk As A % Of All Class Talk	Average # Of Words Per Pupil Utterance	% Of Pupil Talk Coded As Analysis	% Of Pupil Talk Coded As Grouping	% Of Pupil Talk Coded As Recall	Cornell Class Reasoning	Cornell Conditional Reasoning
GRADE 5	CONTROL	22.4	5.52	0	5.6	94.4	23.8	45.7
		23.6	7.38	0	10.5	89.5	5.3	21.7
		8.7	1.15	0	23.1	76.9	31.2	37.2
	EXPERIMENTAL	25.6	8.47	2.7	21.6	75.7	24.0	37.1
		31.0	5.22	0	11.1	88.9	23.0	27.5
		28.2	6.06	0	14.8	85.2	19.6	34.5
	$\bar{X}$	23.25	5.633	0.47	14.45	85.10	21.15	33.95
	σ	7.78	2.513	1.10	6.80	7.42	8.64	8.37
GRADE 6	CONTROL	28.9	6.86	0	11.5	88.5	34.1	39.3
		22.5	2.80	0	12.5	87.5	30.4	35.7
		22.6	3.71	0	25.0	75.0	25.7	30.7
	EXPERIMENTAL	33.8	6.11	0	16.6	83.4	24.4	39.6
		25.4	4.95	0	14.8	85.2	35.2	41.1
		30.4	5.19	0	16.1	83.9	17.8	21.0
	$\bar{X}$	27.27	4.937	0.00	16.08	83.92	27.93	34.57
	σ	4.54	1.50	0.00	4.80	4.80	6.59	7.63

TABLE 6

GRADEWISE ORGANIZATION OF POST-TREATMENT DATA
FOR PUPILS ON SEVEN PUPIL BEHAVIOR VARIABLES

Grade 5 vs. Grade 6

		Pupil Talk As A 9% Of All Class Talk	Average # Of Words Per Pupil Utterance	% Of Pupil Talk Coded As Analysis	% Of Pupil Talk Coded As Grouping	% Of Pupil Talk Coded As Recall	Cornell Class Reasoning	Cornell Conditional Reasoning
GRADE 5	CONTROL	19.3	5.88	0	13.3	86.7	23.2	30.7
		25.2	2.69	0	4.5	95.5	13.4	23.9
		16.2	4.90	0	10.0	90.0	34.8	43.7
	EXPERIMENTAL	48.3	8.47	12.5	54.2	33.3	26.5	48.8
		54.4	6.00	6.3	31.2	62.5	33.6	58.4
		43.7	14.25	8.0	72.0	20.0	33.0	59.0
	$\bar{X}$	34.52	7.031	4.47	30.87	64.67	27.42	44.08
	σ	16.27	3.998	5.30	27.11	31.82	8.23	14.40
GRADE 6	CONTROL	23.8	3.62	0	5.6	94.4	38.1	46.8
		11.3	2.08	0	0	100.0	33.6	44.9
		22.6	4.15	0	11.8	88.2	33.9	38.5
	EXPERIMENTAL	33.0	4.81	8.0	40.0	52.0	30.9	39.8
		44.4	7.23	4.2	29.1	66.7	48.7	49.4
		10.7	6.29	0	58.3	41.7	24.6	26.7
	$\bar{X}$	24.30	4.697	2.03	24.13	73.83	34.97	41.02
	σ	12.94	1.859	3.37	22.46	23.98	8.07	8.14

TABLE 7

PRE-TREATMENT DATA FOR PUPILS ON SEVEN VARIABLES OF PUPIL BEHAVIOR WHICH HAVE BEEN STANDARDIZED GRADEWISE

Control vs. Experimental

		Pupil Talk As A % Of All Class Talk	Average # Of Words Per Pupil Utterance	% Of Pupil Talk Coded As Analysis	% Of Pupil Talk Coded As Grouping	% Of Pupil Talk Coded As Recall	Cornell Class Reasoning	Cornell Conditional Reasoning
CONTROL	GRADE 5	9.8908	9.9551	9.5917	8.6986	11.2519	10.2661	11.4033
		10.0449	10.6953	9.5917	9.4192	10.5923	8.1249	8.5370
		8.1298	8.2157	9.5917	11.2720	8.8962	11.1227	10.3881
	GRADE 6	10.3588	11.2844	10.0000	9.0462	10.9538	10.9363	10.6216
		8.9499	8.5726	10.0000	9.2544	10.7456	10.3748	10.1495
		8.9720	9.1805	10.0000	11.8578	8.1422	9.6616	9.4938
	$\bar{X}$	9.3910	9.6506	9.7958	9.9247	10.0970	10.0810	10.0988
	σ	0.8458	1.2079	0.2249	1.3063	1.2646	1.0902	0.9870
EXPERIMENTAL	GRADE 5	10.3020	11.1292	12.0417	11.0514	8.7346	10.2893	10.3762
		10.9961	9.8357	9.5917	9.5074	10.5115	11.1735	9.2297
		10.6362	10.1699	9.5917	10.0514	10.0134	9.7802	10.0656
	GRADE 6	11.4376	10.7834	10.0000	10.1082	9.8918	9.4643	10.6609
		9.5884	10.0086	10.0000	9.7335	10.2665	11.1033	10.8576
		10.6891	10.1689	10.0000	10.0041	9.9959	8.4627	8.2217
	$\bar{X}$	10.6082	10.3462	10.2041	10.0760	9.9022	10.0455	9.9019
	σ	0.6294	0.4992	0.9227	0.5289	0.6153	1.0360	1.0018

TABLE 8

POST-TREATMENT DATA FOR PUPILS ON SEVEN VARIABLES OF PUPIL BEHAVIOR WHICH HAVE BEEN STANDARDIZED GRADEWISE

Control vs. Experimental

		Pupil Talk As A % Of All Class Talk	Average # Of Words Per Pupil Utterance	% Of Pupil Talk Coded As Analysis	% Of Pupil Talk Coded As Grouping	% Of Pupil Talk Coded As Recall	Cornell Class Reasoning	Cornell Conditional Reasoning
CONTROL	GRADE 5	9.0615	9.7120	9.1560	9.3521	10.6923	9.4876	9.0707
		9.4242	8.9143	9.1560	9.0275	10.9689	8.2973	8.5984
		8.8710	9.4669	9.1560	9.2304	10.7961	10.8962	9.9737
	GRADE 6	9.9614	9.4206	9.3979	9.1749	10.8570	10.3879	10.7097
		8.8952	8.5920	9.3979	8.9256	11.0903	9.8303	10.4764
		9.8687	9.7058	9.3979	9.4511	10.5987	9.8674	9.6906
	$\bar{X}$	9.3636	9.3019	9.2769	9.1936	10.8338	9.7944	9.7532
	σ	0.4667	0.4534	0.1342	0.1960	0.1822	0.8844	0.8114
EXPERIMENTAL	GRADE 5	10.8438	10.3595	11.5162	10.8604	9.0141	9.8883	10.3278
		11.2188	9.7420	10.3455	10.0121	9.9319	10.7505	10.9946
		10.5611	11.8049	10.6665	11.5169	8.5961	10.6776	11.0363
	GRADE 6	10.6742	10.0607	11.7708	10.7066	9.0905	9.4956	9.8503
		11.5537	11.3628	10.6436	10.2212	9.7030	11.7018	11.0290
		8.9488	10.8570	9.3979	11.5216	8.6613	8.7147	8.2416
	$\bar{X}$	10.6334	10.6978	10.7234	10.8064	9.1661	10.2047	10.2466
	σ	0.9031	0.7909	0.8527	0.6335	0.5451	1.0572	1.0935

TABLE 9

ANOVA HYPOTHESES TESTS TO DETECT PRE-TREATMENT DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUP TEACHERS ON THIRTEEN VARIABLES OF TEACHER BEHAVIOR
CONTROL VS. EXPERIMENTAL

VARIABLE	MEAN SQUARE	F
1. Rhetorical Questions (%)	71.7628	0.8910
2. Information Questions (%)	59.6213	0.4329
3. Leading Questions (%)	36.8909	0.0786
4. Probing Questions (%)	1.4700	1.0000
5. Related Questions (%)	51.2921	0.0328
6. Closure Responses (%)	61.6696	0.0216
7. Sustaining Responses (%)	72.6608	0.3512
8. Extending Responses (%)	6.0221	2.5219
9. Questions and Responses (%)	138.8513	0.7691
10. Instruction (%)	55.7803	1.0099
11. Management (%)	84.4776	0.0914
12. Teacher Talk (%)	28.0148	6.2124
13. Average Words/Utterance (#)	3.3930	0.0302

$F_{.01}(1,10) = 10.04$

**Significant at .01 level

TABLE 10

ANOVA HYPOTHESIS TESTS TO DETECT PRE-EXPERIMENTAL BETWEEN GROUP DIFFERENCES IN THE REASONING SKILLS OF CLASSES OF FIFTH AND SIXTH GRADE PUPILS WHEN DATA HAVE BEEN STANDARDIZED GRADEWISE CONTROL VS. EXPERIMENTAL

VARIABLE	MEAN SQUARE	F
1. Pupil Talk As A % Of All Class Talk	0.5553	8.0039
2. Average Number Of Words Per Pupil Utterance	0.8536	1.7154
3. % of Pupil Talk Coded As Analysis	0.4501	1.1110
4. % of Pupil Talk Coded As Grouping	0.9930	0.0690
5. % of Pupil Talk Coded As Recall	0.9885	0.1149
6. Cornell Class Reasoning	1.1303	0.0033
7. Cornell Conditional Reasoning	0.9882	0.1175

$F_{.01}(1,10) = 10.04$

of interest. Type I error was set at .01 to minimize the collective error of rejecting a true hypothesis due to chance alone.

Results of the Study

Teachers:

At the end of the experimental period, the two groups of teachers were found to be statistically different in seven of the thirteen variable categories of interest.

ANOVA results for teachers are reported in Table 11. Based upon those statistics, the hypothesis of no post-treatment differences in behavior between treatment groups was rejected. Those results are reported below in terms of post treatment means:

(1) The proportion of higher cognitive order questions asked was significantly greater for GSA trained teachers than for control group teachers.

Variable	GSA Training	No Training
Leading Questions	33.60%	7.68%
Probing Questions	8.12%	0.62%

(2) The proportion of questions asked which were logically related to previous questions was greater for GSA trained teachers than for control group teachers.

Variable	GSA Training	No Training
Related Questions	53.75%	29.12%

(3) The proportion of responses to pupil talk which served to terminate either a current category of thought or the previous pupils oral participation was significantly less for GSA trained teachers than for control group teachers.

Variable	GSA Training	No Training
Closure Responses	43.63%	82.73%

(4) The proportion of responses to pupil talk which served to maintain or elevate the previous pupil's oral participation at the same or at a higher cognitive level was significantly greater for GSA trained teachers than for control group teachers.

Variable	GSA Training	No Training
Sustaining	39.73%	16.55%
Extending	16.58%	0.72%

TABLE 11

ANOVA HYPOTHESES TESTS TO DETECT POST-TREATMENT DIFFERENCES BETWEEN THE CONTROL AND EXPERIMENTAL GROUP TEACHERS ON THIRTEEN VARIABLES OF TEACHER BEHAVIOR
CONTROL VS. EXPERIMENTAL

VARIABLE	MEAN SQUARE	F
1. Rhetorical Questions (%)	123.9388	7.6549
2. Information Questions (%)	161.6803	4.5348
3. Leading Questions (%)	44.8848	44.8931 **
4. Probing Questions (%)	4.4596	37.8396 **
5. Related Questions (%)	49.8363	36.5276 **
6. Closure Responses (%)	87.5566	52.3824 **
7. Sustaining Responses (%)	58.1108	27.7470 **
8. Extending Responses (%)	10.9876	68.7368 **
9. Questions and Responses (%)	86.2608	6.2292
10. Instruction (%)	102.5968	0.6505
11. Management (%)	17.2593	13.0557 **
12. Teacher Talk (%)	135.0181	8.3193
13. Average Words/Utterance (#)	3.2248	0.4733

$F_{.01}$ (1,10) = 10.04

** Significant at .01 level

(5) The proportion of teacher talk which served to manage either pupil behavior or classroom procedure was significantly less for GSA trained teachers than for control group teachers.

Variable	GSA Training	No Training
Management	3.40%	12.70%

Pairwise contrasts were computed using Tukey's HSD procedure since sample sizes were equal. None of the contrasts for the above named seven variables contained zero, thus supporting the rejection of the hypotheses of equivalent means for those seven variables with significant F-ratios. Data for those contrasts are listed in Table 12.

Pupils:

At the end of the experimental period, the two groups of classes of participating teachers were found to be significantly different in four of the seven variable categories of interest. ANOVA results for classes of pupils are reported in Table 13. Based upon those statistics the hypothesis of no differences between treatment groups was rejected. Those results are reported below in terms of standardized post treatment means:

(1) The complexity of pupil utterances was significantly greater for pupils in classes of GSA trained teachers than it was for pupils in classes of teachers in the control group.

Variable	Classes of GSA Trained Teachers	Classes of Teachers Not Trained in GSA
Average # Words/ Utterance	10.6978	9.3019
Analysis	10.7234	9.2769
Grouping	10.8064	9.1936

(2) The proportion of pupil utterances which were at the information giving level was significantly less for pupils in classes of GSA trained teachers than for pupils in classes of control group teachers.

Variable	Classes of GSA Trained Teachers	Classes of Teachers Not Trained in GSA
Recall	9.1661	10.8338

Post hoc comparisons using Tukey's procedure were computed for each of the four variables with significant F-ratios. None of the contrast intervals contained zero thus supporting the rejection of the hypothesis of no difference between groups of classes following treatment. Data for Tukey Contrasts are reported in Table 14.

TABLE 12

PAIRWISE COMPARISONS BETWEEN MEANS FOR TEACHER BEHAVIOR VARIABLES WITH SIGNIFICANT POST TREATMENT F-RATIOS: TUKEY'S HSD PROCEDURE

VARIABLE	HSD[(a)]	$D=\overline{X}_e - \overline{X}_c$ [(b)]	$D-HSD \leq \Psi \leq D+HSD$
Leading Questions	12.25	25.92	$13.67 \leq \Psi \leq 38.17$ **
Probing Questions	3.86	7.50	$3.64 \leq \Psi \leq 11.36$ **
Related Questions	12.91	24.63	$11.72 \leq \Psi \leq 37.54$ **
Closure Responses	17.12	-39.10	$-21.98 \leq \Psi \leq 56.22$ **
Sustaining Responses	13.94	23.18	$9.24 \leq \Psi \leq 37.12$ **
Extending Responses	6.06	15.86	$9.80 \leq \Psi \leq 21.92$ **
Management Talk	7.60	-8.67	$-1.07 \leq \Psi \leq -16.27$ **

** Reject Ho: $\mu_{i}(e) - \mu_{i}(c) = 0$, $\alpha = .01$

(a) $HSD = q_{\alpha,v}\sqrt{\frac{MS\ i}{n}}$; $q_{.01,10} = 4.48$, n = 6, MS from Table 11

(b) $\overline{X}_{i}(e)$ and $\overline{X}_{i}(c)$ can be found in Tables 2a and 2b

TABLE 13

ANOVA HYPOTHESIS TESTS TO DETECT POST-EXPERIMENTAL BETWEEN GROUP DIFFERENCES IN THE REASONING SKILLS OF CLASSES OF FIFTH AND SIXTH GRADE PUPILS WHEN DATA HAVE BEEN STANDARDIZED GRADEWISE

VARIABLE	MEAN SQUARE	F
1. Pupil Talk As A % Of All Class Talk	0.5163	9.3678
2. Average Number Of Words Per Pupil Utterance	0.4153	14.0748 **
3. % of Pupil Talk Coded As Analysis	0.3722	16.8637 **
4. % of Pupil Talk Coded As Grouping	0.2194	35.5692 **
5. % of Pupil Talk Coded As Recall	0.1644	50.7536 **
6. Cornell Class Reasoning	0.9493	0.5319
7. Cornell Conditional Reasoning	0.9268	0.7877

$F_{.01}(1,10) = 10.04$

TABLE 14

PAIRWISE COMPARISONS BETWEEN MEANS FOR PUPIL BEHAVIOR VARIABLES
WITH SIGNIFICANT POST TREATMENT F-RATIOS
TUKEY'S HSD PROCEDURE

VARIABLE	HSD[a]	$D-\bar{X}_e - \bar{X}_c$[b]	$D-HSD \leq \Psi \leq D+HSD$	
# Words Per Pupil Utterance	1.1786	1.3959	$0.2173 \leq \Psi \leq 2.5745$	**
Analysis	1.1157	1.4465	$0.3308 \leq \Psi \leq 2.5622$	**
Grouping	0.8566	1.6128	$0.7562 \leq \Psi \leq 2.4694$	**
Recall	0.7414	-1.6677	$-2.4091 \leq \Psi \leq -0.9263$	**

**Reject Ho: $\mu_i(e) - \mu_i(c) = 0$, $\alpha = .01$

(a) $HSD = q_{\alpha, v}\sqrt{\frac{MSi}{m}}$; $q_{.01, 10} = 4.48$, $n = 6$, MS from Table 13

(b) $X_i(e)$ and $X_i(c)$ can be found in Table 8

Analysis of the Results

An improvement in the relatedness of questions suggests logically that pupils should improve their participation due to diminished confusion alone. Further, elevating the level of questioning should produce higher order behaviors in pupils and a reduction in trivial (recall) utterances. So too, encouraging pupils to continue or elevate their thinking and talking should produce more complex utterances as well as higher level thinking. With a decrease in confusion and an increase in pupil participation, there should be a decrease in the necessity for management from teachers. The results as described above do have a logical sense about them.

The treatment variable, GSA training, operated to modify teacher behavior. The results suggest that such modifications did occur and that they were significant. The results also suggest that modifications occurred in pupil behavior and that they, too, were significant. It would be naive to conclude that all modifications in teacher behavior are solely attributable to GSA training. The decrease in the management behavior of GSA trained teachers was more casually related to an increase in pupil involvement. However, GSA training was the prime influence, the only planned variable differentiating the two groups.

Summary

Twelve intermediate grade teachers and their classes were identified in ten rural school districts near Fresno, California. The ten school districts were randomly assigned to two equal groups. One of the groups was randomly assigned to receive training in the use of Parsons' Guided Self-Analysis (GSA), a procedure designed to instigate modification of the user's verbal behavior. The other group became the control group.

Each of the teachers, six in each group, was videotaped prior to treatment in a social science setting. Teachers were videotaped four or more times after treatment began. The pupils in the classes of participating teachers were pretested prior to treatment and posttested after thirteen weeks of treatment using two published critical thinking tests. The test results and the first and last sets of videotapes were the sources of data used for hypothesis testing in this study.

The two groups of teachers were not significantly different on thirteen variables of teacher behavior prior to treatment. The two groups of classes of pupils were not significantly different on seven variables of pupil behavior prior to treatment.

At the end of thirteen weeks of treatment, the two groups of teachers were statistically different on seven of thirteen variables and pupils were statistically diffe[illegible]n four of seven variables. These differences were attribu[illegible] treatment effects.

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